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Development of Future Allied Maritime Patrol Aircraft (MPA)

Can We Afford Business as Usual?

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Development of Future Allied Maritime Patrol Aircraft (MPA):

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Captain William G. Bozin, United States Navy

Abstract

For over 50 years, U.S. Navy maritime patrol aircraft (MPA) have performed their venerable mission, for almost 30 years now in the Lockheed P-3 Orion. But as many P-3s approach the end of their service life, the U.S. Navy has no follow-on maritime patrol aircraft development program currently funded. This paper examines the military requirement for, as well as possible means for developing and producing, an MPA to meet future needs, not just from the U.S. perspective, but taking a global view. Given the current threat and economic realities, the U.S. may not have the luxury of buying a maritime patrol aircraft which we design, and an American company builds, with all U.S. parts and materials. Even with a valid military mission requirement, the new generation MPA may not meet the cost-benefit threshold of the new world order and slow economic growth (both at home and abroad). We must break the existing, often cozy, paradigms of weapon system procurement which evolved during the Cold War, especially of late. This paper seeks to find more efficient and affordable alternatives to fulfilling our need for an allied MPA into the twenty-first century.

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I. Introduction

> The U.S. Navy's patrol aviation lineage goes back further than any other naval aviation community's, and its underlying surveillance, reconnaissance, and antisurface warfare missions remain as valid today as they were 75 years ago. In addition, maritime patrol aviation has, over two world wars and one persistent cold war, been a key player in antisubmarine warfare, while sustaining competence in its other primary mission areas. *The patrol aviation community was not generated during the Cold War to counter a Soviet submarine threat, and it has not had to invent a multimission role as Soviet submarines have returned home to political turmoil.*
>
> Rear Admiral A. R. Maness, USN[1]

The venerable U.S. Navy patrol mission has been performed by a variety of aircraft -- for the past forty-plus years almost exclusively by products of the Lockheed Aircraft Corporation, including the P-2 Neptune and, for almost thirty years now, the P-3 Orion. Our Navy and our nation have been well served by these aircraft, which have been continually updated to meet the ever-increasing military and political challenges of the twentieth century.

As Admiral Maness says, the underlying maritime patrol aviation (MPA) missions "remain as valid today as they were 75 years ago." But some things have changed over the years. Most changes have been evolutionary, but some have been revolutionary, such as the significant readjustments to the world order brought about by the end of the Cold War and the dissolution of the Soviet Union. With these changes has come a clarion call for downsizing our military forces, as our nation struggles to balance its defense requirements with our domestic economic needs.

This necessary downsizing and restructuring, in the face of a reduced and changing threat, has brought extreme pressures to bear on the defense budget. The debate over which military hardware programs to procure has been heated, especially coming on the heels of the

unprecedented buildup of the 1980's. The pressure is now on -- intense pressure -- to identify those weapon systems which we absolutely need for today's -- and tomorrow's -- world. We must maintain existing ones that we still need and procure at the cheapest possible cost only those new systems that are absolutely required.

The U. S. Navy has no follow-on maritime patrol aircraft development program currently funded. This paper examines the military requirement for, as well as possible means of developing and producing, an MPA to meet future needs, not just from the U.S. perspective, but taking a global view. Given the foregoing threat and economic realities, the U. S. may not have the luxury of buying a maritime patrol aircraft which we design, and an American company builds, with all U. S. parts and materials. Even with a valid military mission requirement, the new generation MPA may not meet the cost-benefit threshold of the new world order and slow economic growth (both at home and abroad). We must break the existing, often cozy, paradigms of weapon system procurement which evolved during the Cold War, especially of late. This paper seeks to find more efficient alternatives to fulfilling our need for an allied MPA into the twenty-first century.

II. Mission Requirements

As stated previously, the maritime patrol aircraft is a true multi-mission platform. Although more widely known as an anti-submarine warfare (ASW) aircraft, it can conduct a wide variety of missions, making it one of the most functional and flexible systems available to any operational commander. Although mission requirements are constantly evolving, those listed in

this section are current today and projected to be essential for war-fighting well into the next century. Most are requirements of our allies as well. Let's look briefly at some of them.

Anti-Submarine Warfare

During the 1970s and 1980s, MPA gained a rightful reputation as ASW weapon systems of exceptional capability. Their high-visibility mission of locating and tracking patrolling Soviet ballistic missile submarines was a cornerstone of our national strategic defense. During this period, the preponderance of MPA training and operations was focused on this critical mission area. The dissolution of the Soviet Union has changed the calculus of national defense overall, and certainly reduced the importance of ASW. However, the submarine threat still exists, if not from the large number of Russian or other CIS submarines which remain operational, then surely from the submarines of other potential adversaries, such as Iran.

ASW is also among the most difficult forms of warfare. It is fought in a medium which is far from transparent to modern sensors. Therefore, the development of expertise in ASW is a painstaking process; maintaining this capability is equally demanding. Although today's ASW threat may be reduced from that of previous decades, a significant capability remains. If competence in this mission area is permitted to erode, it will be very difficult to reconstitute. For all the foregoing reasons, ASW remains a critical naval warfare mission; the maritime patrol aircraft remains the principal airborne platform for its execution.

Anti-Surface Warfare

This mission area dates to the inception of maritime patrol aviation. Today's sensors and systems have brought P-3s into the twenty-first century. The inverse synthetic aperture radar (ISAR) provides a standoff imaging and identification capability. Coupled with satellite communications (SATCOM) and state-of-the-art operational information exchange systems, the ISAR-equipped MPA is an ideal over-the-horizon targeting (OTH/T) platform. Further, the P-3 itself can deliver the Harpoon air-to-surface missile against hostile surface targets.

Coastal Patrol/Ocean Surveillance

In this mission, which is becoming increasingly important in the new world order, MPA can serve as the "eyes and ears" of the fleet. ISAR provides a superb search, tracking, imaging, and identification capability, even in coastal waters. The MPA electronic support measures/countermeasures (ESM/ECM) systems provide monitoring, collection and identification of the adversary's electronic emissions. The range and endurance of MPA make them uniquely well-suited to this surveillance mission.

Command, Control, Communications and Intelligence (C3I)

In addition to the foregoing radar and ESM systems, many P-3s incorporate stand-off optical systems which combine to form an outstanding intelligence collection platform. Coupled with the above, the robust communications suite, including UHF, VHF, HF and SATCOM (each with plain voice and data link), give MPA a stand-alone C3I capability unmatched by any other naval aircraft.

Additional Missions

The above constitute the primary MPA missions. These areas are where the bulk of training and operations is oriented. The following list (not all-inclusive) provides a sampling of the additional mission requirements of U.S. and allied MPA:

search and rescue;
counternarcotics/drug interdiction operations;
indications and warning data collection;
peacekeeping - surveillance and monitoring;
peacetime presence missions;
territorial water surveillance;
fisheries patrol;
medical evacuation;
delivery of emergency supplies (at sea);
disaster support; and
special operations.

III. Current MPA Aircraft and Inventories

The P-3 is by far the leading maritime patrol aircraft in the world today. Derived from the Lockheed Electra commercial turboprop aircraft, 644 P-3s have been produced for eleven different countries, with several more actively looking to purchase either new or used versions. Although the basic airframe design has remained essentially unchanged for the past 30 years, one engine upgrade and numerous mission avionics upgrades have enabled this workhorse to stay ahead of the threat.

The airframe and powerplant combine to provide a safe, reliable weapon system of long range, high endurance and large payload. The Allison T-56 turboprop engines operate continuously at 100% RPM and provide instantaneous power response through the Hamilton Standard variable pitch propellers. This translates to increased safety margins for inexperienced

aircraft commanders in some very demanding operating environments. The P-3's 4000 nautical mile (NM) range translates to a nominal 12-hour mission profile (1200 NM transit to station - 4 hours on station - 1200 NM return), with a load of 84 monobuoys and up to eight MK-46 torpedoes and/or AGM-84 Harpoon air-to-surface missiles.

Mission avionics have been upgraded continuously throughout the years and tailored to individual country's needs. The U.S. version alone has gone through the P-3A, P-3B, P-3B Mod, P-3C, P-3C Update I, P-3C Update II, P-3C Update II.5 and the P-3C Update III. Each aircraft represented a significant warfighting capability improvement over the previous model.

In 1987 the U.S. Navy contracted with Boeing Aircraft Corporation to develop the next generation avionics upgrade, the Update IV. This contract was cancelled in October, 1992, presumably for convenience of the government, although specific terms of the cancellation have not yet been disclosed. At this point, any successor to the P-3 would likely have mission equipment based around the current Update III avionics suite, plus ISAR, global positioning system (GPS) navigation systems and advanced C3I suites.

There are only two other aircraft in the world today which come close to the measure of the P-3 as a true maritime patrol aircraft, the British Nimrod and the French Atlantic. Both are capable of conducting ASW, anti-surface warfare, surveillance and the myriad additional missions described previously. The Nimrod, like the P-3 a commercial derivative, was based upon the 1950s British Aerospace (Bae) Comet airliner. A four-engine turbojet, the Nimrod MR2 has a nominal 8-hour endurance in the ASW role (15 hours refueled), a rapid transit speed and advanced avionics. Nimrod is approaching the end of its service life and, as with other aging aircraft, its operating costs are high (and increasing).[2]

Unlike the P-3 and the Nimrod, the Dassault Atlantic was designed and built specifically as an MPA. In service for over 25 years, it is operated by the French, Germans and Italians. An efficient twin-engine turboprop, it has a wingspan and length comparable to the P-3, but not nearly the range, endurance or payload capacity. Currently in production for the French Navy is the upgraded Atlantic 2, which incorporates new mission avionics to produce a more capable platform.[3]

Several smaller twin-turboprop aircraft are filling a more limited surveillance and patrol role for other countries. The Dutch Fokker Maritime Enforcer MK 1 and MK 2 based upon the Fokker F-27 and F-50, respectively, are operated by Peru, Thailand, Spain, the Philippines, the Netherlands, Nigeria and Angola. The joint Spanish/Indonesian CN-235 airliner has made a successful transition to military transport and MPA roles, finding many customers in the Pacific Rim region, and having just been acquired by Ireland. These two aircraft, as well as several others, have some limited patrol capability, but are not true *blue-water maritime patrol aircraft* in the sense of the P-3, Nimrod or Atlantic. They clearly could not meet the U.S. Navy's demanding mission range, endurance and payload requirements.[4]

Inventory

The current world inventory of operational P-3s, Nimrods and Atlantics is as follows:

P-3	United States	341	Nimrod	U.K.	30
	Canada	18			
	Australia	19	Atlantic	Italy	15
	New Zealand	6		Germany	19
	France	29			
	Netherlands	13			
	Spain	5		Total	64
	Portugal	6			
	Iran	6			
	Japan	81			
	Total(Non-US)	154			

Note: The Japanese are building 19 more P-3s (for a total of 100) under a licensing agreement between Lockheed and Kawasaki. Korea has eight new P-3s under contract with Lockheed (to be built in the U.S. for delivery in 1995.)[5,6]

IV. Future Requirements

The U.S. Navy's current MPA force level requirements and inventory projections are shown in Table 1. From the early 1970s, the USN maintained a force of 24 active P-3 squadrons (9 aircraft per squadron) and 13 reserve squadrons (6-8 aircraft per squadron). In 1988 each active squadron was reduced to 8 aircraft and the reserves stabilized at 8 as well. The active force has now been reduced to 18 squadrons, a reduction of 25% in terms of squadrons, but a

reduction of 33% in terms of aircraft (i.e., from 24 9-aircraft squadrons (216 aircraft) to 18 8-aircraft squadrons (144 aircraft)). On the reserve side, the Navy recommends reducing from 13 to 9 squadrons, in order to free up more aircraft for the active force. However, Congress continues to pass legislation which calls for maintaining the 13. This issue is not yet resolved.[7]

As you can see from Table 1, there is a total requirement for 293 aircraft to support the 18 active/9 reserve squadron mix, including training (FRS), RDT & E, special support (VPU) and pipeline (a catch-all category covering downtime for depot repairs, mission upgrades, special projects, etc.).

Also depicted in Table 1 is the projected reduction in P-3 inventory, based upon current estimates of service life remaining on existing airframes. The operational service life of the P-3 is 29.6 years. Service life is based upon fatigue of the airframe, which in turn is predicated upon estimated flight hours, cycles (pressurizations and depressurizations) and other estimated flight loads and characteristics. It appears that the P-3 is not "fatiguing" as fast as projected; however, it is corroding faster than expected. Even with aggressive corrosion prevention and treatment programs, the highly corrosive salt water atmosphere in which P-3s routinely operate and are based has had a significant effect on airworthiness. In some cases excessive rework is required, in others aircraft must be retired. All of these factors have been considered in deriving the inventory projections in Table 1. The Navy is currently investigating the feasibility of initiating a sustained readiness program (SRP) which would repair or replace structural members and other components susceptible to corrosion. Table 1 assumes no SRP. This program will be addressed further in the section on options.

The bottom line is that inventory is projected to dip below the 293-aircraft requirement in 1998. At this point a replacement must be ready to enter the fleet or our operational requirement will not be met. It may be argued that a solution to this shortfall is a reduction in the operational requirement. For the purposes of this paper, it will be assumed that the 18 active/9 reserve squadron mix will remain the requirement for the foreseeable future. Given the multi-mission capability of MPA, especially with their cost-effectiveness vis-a-vis ships which might otherwise have to take their place, it is likely that this requirement will remain valid.

There is a substantial requirement for both replacement and "new requirement" allied MPA as well. As stated previously, their mission requirements are very similar to the P-3's. To date, of course, only those countries operating either the P-3 or the Nimrod have demonstrated a specific requirement for the range, endurance and payload-carrying capabilities those aircraft possess.

France is currently upgrading its MPA force to the Atlantic 2. It may be presumed that the French have no need for a follow-on MPA in the near and mid-term. Both the British and the Germans had exhibited a strong interest in the Lockheed P-7 prior to its termination. (The P-7 will be discussed briefly in the next section.) In fact, Germany had signed a memorandum of understating (MOU) with Lockheed in April, 1989 to procure 12 P-7s to be delivered between 1997 and 2000. The U.K. and Italy were seriously interested as well, but had nothing in writing. Their requirements are for 25 and 16 aircraft, respectively. All three still have requirements for a new MPA and at least Germany and the U.K. are leaning toward a new P-3, although a production run on the end of the Korean production (which would have reduced unit costs) is now impossible, due to timing constraints.[8]

In summary, then, these are the firm allied (non-U.S.) requirements for MPA as of this writing:

United Kingdom	25
Italy	16
Germany	12
Total	53

In addition, several countries have expressed some desire to establish an MPA force of undetermined size and capability. These include Turkey, Saudi Arabia, and Greece. Further, all P-3 operators will be facing a need to replace their aircraft as they approach the end of their operational service life. ***The military requirement for a new allied MPA is undeniable.***

V. Mission Platform or Mission System?

The preceding discussion of inventories and requirements has considered the MPA as a complete weapon system, that is, an integral combination of airframe and mission avionics. Historically, allied MPA have been developed in this fashion. Although avionics upgrades had been made to P-3s and other MPA throughout the years, it was not until the U.S. Navy began its search for a successor to the P-3C Update III that the developmental framework changed. Requirements were generated and contracts were awarded to develop -- independently of each other -- an airframe and a mission avionics package.

As discussed in Section III, in 1987 the Boeing Aircraft Corporation won a competition to develop the next generation avionics upgrade, the Update IV. The contract was subsequently cancelled in October, 1992. The separate airframe development contract met a similar fate.

John Lehman, Secretary of the Navy under President Ronald Reagan, believed fervently that competition among contractors was necessary to produce the most cost-effective weapon systems for this nation. He further believed that fixed-price, rather than cost-plus, contracts were better suited to containing costs. When the requirement arose to replace the aging P-3 airframe, Secretary Lehman chose not to go solely to Lockheed, who had a long-time monopoly on building patrol aircraft for the U.S. Navy. Rather, he directed that a fixed-price incentive, full-scale engineering development contract for design, development and production of two prototype long-range air antisubmarine warfare-capable aircraft (LRAACA) be competed. Bids could include either a P-3 derivative or a commercial derivative. Lockheed's bid was (quite naturally) a stretched out, re-engined version of the Orion, termed the P-7. Boeing offered a B-757 derivative and McDonnell-Douglas proposed an MD-90 (modernized DC-9) with a new technology, unducted fan engine.

To few people's surprise, Lockheed won the competition to develop the aircraft. According to Aviation Week and Space Technology, sometime in 1989 the company "began to determine the requirements for the program could not be accomplished... Lockheed originally thought, for example, that the overall program -- including tooling and aircraft structure -- might have up to 40% commonality with the P-3C, but the re-designed aircraft had a commonality level of less than 5% with its predecessor. Some of the engineering specifications also were troublesome for Lockheed. A specification for repeated loads analysis had a fundamental bearing on structural design and weights, but Lockheed and the Nary did not reach agreement on the issue until 18 months into the program."[9]

In July 1990 the Navy terminated the contract for default, maintaining that Lockheed had "failed to make adequate progress in development of an aircraft design which met contract performance requirements. The program was delayed by about two years when it was cancelled, and Lockheed (in 1989) took a $300 million write-off on the project." Lockheed disputed the Navy's determination and the case is currently in litigation.[10]

The failure of both the P-7 and the Update IV avionics programs should not be seen as indictments of this new concept of developing the MPA airframe and mission systems independently. The factors which led to their demise are some combination of the difficulties associated with designing advanced technology systems, fixed price contracting, excessive and/or modified) requirements, shrinking budgets and changing threats.

In spite of these failures (but certainly not ignoring them), I think it is important that we continue to view MPA as weapon systems which can best be procured as separate airframes and mission avionics packages. To reasonably limit the scope of this paper, *I will address only the options for developing a new MPA airframe*, although the options derived will in many ways be applicable to avionics development and procurement, as well.

VI. International Collaboration Approaches

Before addressing specific options which may be available for developing and producing a new MPA airframe, it would be instructive to define the terms and examine the approaches available for international collaboration. (U.S. manufacturer collaboration or "teaming," will be addressed in Section VII, as well, but does not require explanation beforehand).

The approaches available today for armaments collaboration are many and varied. They are interrelated in nature and there is sometimes overlap among approaches and programs. One common thread they share is the document which forms the basis for most international armaments cooperation agreements, the memorandum of understanding. MOUs are important because they provide standardization within the alliances by delineating the cooperative actions of each party. Each approach will be described briefly below.

Codevelopment

In codevelopment, companies (or industries) of two or more nations undertake to design a weapon system. "Codevelopment is the most difficult of all forms of cooperation to carry out.... Close associations are needed, often requiring the formation of integrated, multinational design teams and a significant transfer of technology and know-how among partners...The benefits, however, can be substantial. Although R & D costs may be greater because of the inefficiencies of collaboration, the cost to individual participants is less.... Also, each nation acquires technology and know-how from the partners, adding to its overall defense technology base. A greater understanding of the requirements usually results, increasing the likelihood of equipment standardization, interoperability and common logistics." [11]

Codevelopment programs can take many different shapes. Rather than integrating the entire effort, different companies may be given developmental responsibilities for different portions of the program. A related arrangement may be to have different design teams develop interchangeable (but different) subsystems, thereby establishing dual sources for future production.

The Nunn-Roth-Warner Amendment to the FY 1986 Defense Authorization Act encourages international codevelopment by:

-- authorizing specific levels of DOD funding exclusively for NATO cooperative R & D projects.

-- authorizing additional funds for side-by-side testing of allied and U.S. systems, and

-- directing that DOD identify and consider cooperative developments or existing allied systems as alternatives to U.S development programs or systems throughout the acquisition process.[12]

Although the Amendment has been criticized as encouraging some "pork barrel" projects, there appears to be "a much higher level of R&D cooperation now than before the Nunn Amendment was enacted for fiscal year 1986."[13]

Armaments which have been codeveloped by U.S. firms include the multiple launch rocket system (MLRS), rolling airframe missile (RAM), and the long-range standoff missile (LRSOM).

Coproduction

Coproduction (or dual production) is the most widely used form of government-to-government equipment cooperation besides foreign military sales (FMS). (Under the FMS program, DOD serves as the contracting agency for a foreign government that wishes to buy equipment from U.S. manufacturers. For the past several years, allies have been moving away from FMS -- due to the costs of using the U.S. government as a middleman -- and toward direct commercial purchases.) Participation in production may or may not stem from prior

codevelopment; each agreement is tailored to the specific situation. "Usually the coproduction involves two or more assembly lines, frequently one in each participating country. Fabrication of parts and components may be duplicative, leading to two or more independent or parallel production sources and assembly lines; or it may be non-duplicative, leading to one interdependent or joint production source with, perhaps, several final assembly lines."[14]

As with codevelopment, substantial commitments (both political and financial) are required for successful agreements. Also, while dual production eliminates the benefits of economies of scale, it should reduce program cost to each partner, as well as providing for alternate sources of production for international competitive armaments procurement.

Examples of successful coproduction programs include the AGM-65 Maverick missile, the Stinger air defense missile, the Penguin air-to-surface missile and the AV-8B Harrier aircraft.

Licensed Production

Licensed production may be considered a subset of coproduction. In this arrangement, a nondeveloping company is granted the right to produce through either a formal licensing agreement or other authorizing instrument such as a letter of agreement (LOA). These agreements specify detailed terms and conditions under which the right to produce is granted, as well as the amount and form of consideration or payment. Normally, such agreements restrict production to fulfillment of the purchasing country's defense needs, although a follow-on capability may be established.

Systems which have been produced under license include the TOW anti-tank weapon, the Hawk air defense missile, and the F-104, F-15 and P-3 aircraft.

Opening Defense Markets

This collaborative approach is based on reciprocal bilateral MOUs. The U. S. has entered into such MOUs with nearly every NATO country, as well as many other allies. In this approach, countries look to each other to satisfy existing or emerging requirements. If a partner has the required equipment, that nation will provide it through either direct commercial sales (DCS) or FMS. "While varying in scope and coverage and in the degree of reciprocity required, the agreements waive buy-national preferences in procurement of defense equipment."[15]

Program Package

A fairly new concept in cooperation, the program package may combine several different collaborative approaches, such as coproduction and/or codevelopment. It may be done at the industry-to-industry, government-to-government or industry-to-government levels. With a program package, each party to the acquisition realizes some of the benefits, thereby avoiding the need for offsets.

Perhaps the most significant packaging agreement to date has been the U.S./West German agreement on the Patriot/Roland air defense network. The U.S. purchased U.S.-designed and produced Patriot missiles and provided them (at no cost) to the FRG. In return, West Germany purchased and provided Roland missiles to the U.S. (also at no cost), as well as providing for the operations and maintenance of both the Patriot and Roland missiles at U.S. bases in Germany.[16]

Family of Weapons

A variant of the program package is the family of weapons concept. In this arrangement, participating nations agree to develop and/or produce complementary weapon systems in a certain mission area. This reduces duplication in R & D as well as production. More common in Europe, this concept has not been widely used by the U.S. The prime example of the family of weapons concept is the air-to-air missile family comprised of the Advanced Medium-Range Air-to-Air Missile (AMRAAM) and the Advanced Short-Range Air-to-Air Missile (ASRAAM).

Offsets

One final concept which must be discussed here is offsets, which have become a common feature of international defense sales. "Offsets are direct or indirect conditions of purchase of foreign defense equipment enacted by a purchaser. Offsets aim to increase economic development benefits and reduce the net balance-of-payments costs of such a purchase. Purchasers may require as direct offsets the purchase or production in their country of subsystems or components of the purchased system. Indirect offsets include the purchase of unrelated goods, services or supplies. Most major security partners demand an offset as a condition of their purchasing a U.S.-designed system."[17]

The U.S. government (USG) acknowledges the existence of and requirement for offsets in conducting international arms trade. However, no agency of the USG is permitted to encourage or commit U.S. firms to any offset arrangements nor may government funds be used to finance offsets outside of existing policies and procedures. The government will only guarantee offsets under extraordinary circumstances; individual U. S. firms must negotiate and

fulfill any offset agreements they enter into. In the 1980s, offsets became a part of virtually every significant international arms sale, a trend which continues today.

VII. MPA AIRFRAME OPTIONS

This section will examine several different options for meeting the current and projected maritime patrol aircraft requirement of the United States and its allies. Four general options will be examined: a new aircraft, a commercial derivative, a military derivative and refurbishment of existing airframes. The principles of international collaboration discussed previously, as well as U.S. teaming, may be applicable to more than one option, but they will be addressed primarily in the initial section.

1. A New Aircraft

U.S. Production

This has clearly been the model for U.S. military aircraft development and production to date, and the country has been well-served by U.S. industry in that regard. But even this model has been changing -- significantly some might say -- as aircraft have become increasingly complex and expensive to build. Teaming has emerged over the last decade or so, with some successes and at least one notable failure, the Navy A-12. But development by a single company does not ensure success either, as the F-20 and the P-7 demonstrate.

Perhaps the most compelling argument for continuing U.S.-only development and production of a new MPA is maintenance of the eroding U.S. aircraft manufacturing industrial base. On the commercial side we are down to two manufacturers, Boeing and McDonnell

Douglas, with the latter in serious danger of failing in the near to mid-term. The military component may be more robust in numbers of aircraft manufacturers, but it is changing and shrinking nonetheless. One of the most significant moves is the sale of General Dynamics' aircraft division to Lockheed, a clear sign (along with its other recent divestitures) that the former is selling off assets and exiting from the military aerospace industry, while the latter apparently plans to bolster its long-term position in that arena.

Some paring down of the military aircraft industry is clearly required in this era of decreased military spending and adjustment to new defense requirements; however, we cannot permit our technological edge to erode -- certainly not to disappear. We must stay fully engaged in developing and producing leading-edge technology systems, such as military aircraft. Even though a premium may be paid to undertake this strategy, the investment is worth more than merely the output measured in terms of systems built and contribution to GDP. Investment in development and production of new systems is investment in the ability to preserve the industrial base necessary to react to whatever unknown challenges may emerge from the evolving new world order.

A U.S.-built aircraft can become more affordable if the manufacturer also sells the aircraft to allies, as Lockheed has done over the years with the P-3. This can be done either through foreign military sales (FMS), which have been on the wane, or through direct commercial sales (DCS), which appear to have gained favor in recent years. The problem is that today many allies share the same concerns we do about shrinking budgets and downsizing industrial bases. They are becoming increasingly inclined to participate in the development and/or production of the

weapon systems they procure and operate. This factor pushes us away from U.S.-only production and toward international collaboration.

International Collaboration

The relatively small size of the current allied MPA requirement, as well as the general state of flux -- and downward trend -- of military requirements and defense spending worldwide, militates against any U.S. company (or team) developing or building a new MPA by themselves; with low numbers of production, unit costs naturally rise, often prohibitively. Spreading the costs makes these systems more affordable.

Another factor which makes a maritime patrol aircraft more attractive as an item of codevelopment (or coproduction) is that an MPA airframe is not, in and of itself, a terribly sophisticated weapon system. It is the addition of the avionics that makes it so. Therefore, building an MPA airframe in collaboration with allies does not raise as many sticky issues of technology transfer as would the development of advanced avionics or sensor systems.

The Europeans have already begun a collaborative effort to develop and design a new MPA. A consortium called Europatrol has been formed by Paris-based Dassault Aviation; British Aerospace, London; Deutsche Aerospace, Munich; Construcciones Aeronautics, S.A. (CASA), Madrid; Alenia, Rome and Fokker Aircraft, Amsterdam. Established on September 1, 1992 in Paris, Europatrol intends to develop an MPA for use by member countries in the 2005 - 2015 timeframe.

In the barest conceptual stage at this time, Europatrol's founders have "only agreed to lobby their individual defense ministries to develop a common specification for a future MPA.

'Industry can start this moving and the defense ministers, within the framework of the (NATO) Independent European Program Group, will study the requirements,' Bruno Revellin-Falcoz, vice president for engineering and international affairs at Dassault, said September 10. 'Industry is ready to propose different solutions for that requirement."[18]

Lockheed may be prepared to collaborate, as well. "Irrespective of Lockheed's current dominant position in the world market for MPA, (Lockheed Aeronautical Systems Company President Ken) Cannestra said the company is willing to pursue joint teaming arrangements with European partners to facilitate future international sales. 'I do believe there is a need for international cooperation,' Cannestra said, adding, 'eventually we are all going to have to look in that direction.'" [19]

As an indication of how big a role international trade considerations currently play in these sorts of arrangements, however, Revellin-Falcoz further stated that, "Europatrol is not interested in adding a U.S. company to the consortium at this time, unless that company can bring the U.S. market for new MPA aircraft to Europatrol."[20] They are not interested in the U.S. (through Lockheed or any other American manufacturer) sharing in the potential monetary benefits of any new development and production without Europatrol being able to derive the benefits of selling to the American defense market. Significant offsets would clearly be required in an arrangement of this sort. Any such agreement would have to be mutually beneficial.

2. A Commercial Derivative

Candidates

Several commercial aircraft are potential candidates for derivative development as MPA. The Boeing B-757 and the McDonnell Douglas MD-90 had been proposed in the previous LRAACA competition, which led to the Lockheed P-7 contract. They remain viable candidates, while engine improvements may make the Boeing B-737 a future candidate, as well. Even Airbus Industries has one or more possibilities with its A321 or A320 aircraft.

Potential Benefits

Because MPA airframe requirements are generally compatible with existing commercial airliner airframes, developing a commercial derivative MPA has significant appeal. Some potential benefits of this alternative include:

-- lower risk derivative development,

-- lower unit costs based on high production rates,

-- use of existing logistics, support, rework and training infrastructure,

-- payload growth potential and faster cruise speeds,

-- higher reliability and maintainability, and

-- flexible procurement options, including reconstitution capability.

Potential Problems

While the foregoing benefits are attractive, there are several reasons why the commercial derivative may not be a desirable alternative for MPA replacement. Principal among them are the following:

-- Although commercial aircraft may inherently possess the speed, range and payload capacity required for new MPA, substantial modifications must be made to the airframe during the manufacturing process to fully militarize it. Every attempt should be made in the interest of cost containment to adopt commercial specifications wherever possible. However, commercial airframes are often lacking in the following areas:

--- Corrosion resistance: corrosive materials (including magnesium alloys), which are unsuitable for constant use in marine environments, are used extensively.

--- Low-altitude performance: marginal for successful mission accomplishment due to excessive fuel consumption, maneuvering flight G-limitations and radius of turn/angle of bank limitations, and extremely high deck angles while at maximum endurance, which severely limit field-of-view.

--- Structural strength: in order to carry a standard MPA weapons load, the wings would have to be substantially reinforced; this, coupled with the addition of a bomb bay (which entails substantially more than merely moving the cargo door to the bottom of the aircraft), could create major redesign problems and subsequent significant production costs.

-- Although current production commercial aircraft have robust logistics, rework and training infrastructures to support them, integrating these systems into U.S. and allied military infrastructures would add a significant burden; two different aircraft would have to be supported

simultaneously. Substantial MILCON (due to larger aircraft size) and other funding would likely be required -- and likely not be available -- in the current fiscal climate.

-- There is no current "off-the-shelf" avionics package for new MPA. These systems would have to be developed independently.

-- In order to take advantage of building an MPA on the commercial production line, it would not be possible to install the avionics (which eventually must be developed) concurrently. Instead, avionics systems would have to be installed in the aircraft subsequent to airframe manufacture, requiring an inefficient, time consuming and, likely, expensive retrofit.

-- All of the candidate aircraft have turbofan engines. Although the increased cruising speed provided by these powerplants is desirable, it is on-station endurance which is the critical factor in MPA operations. For the foreseeable future, and barring technological break-throughs in mission systems, the turboprop powerplant will likely continue to provide the mix of sufficient cruising speed, coupled with maximum on-station endurance (particularly at often-required low altitudes), which maximizes MPA mission performance.[21]

3. A Military Derivative

There are few military aircraft in production today, or with "warm production lines," which could serve as potential MPA. The venerable Lockheed C-130 Hercules turboprop transport is, of course, one of them. Although it shares the Allison/Hamilton Standard T-56 engine/propeller combination with the P-3, the comparison pretty such stops there. Its speed, range and flight characteristics on-station are all inferior to the P-3's and, although it does

possess a significant payload capacity, constructing a bomb bay in its slick, flat bottom would mean virtually redesigning the entire aircraft.

Navy E-6 TACAMO aircraft, used for communicating with our ballistic missile submarines, are derived from another venerable aircraft -- the Boeing B-707/720 series, whose military versions include the KC-135, VC-137 and E-3 AWACS aircraft. These large, four-engine turbofan aircraft have the speed, range and payload capability required in future MPA. However, production of these aircraft was concluded in 1992 with the delivery of the last E-6 to the Navy's Fleet Air Reconnaissance Squadron Four (VQ-4). No additional production or procurement is planned. Further, when Boeing competed for the LRAACA contract, it chose as its candidate the newer, more technologically advanced B-757 rather than the B-707/KC-135/E-6 series. Of course, the E-6, as a military aircraft with requisite strengthening and survivability enhancements, might lend itself more easily to conversion to an MPA. However, the window of opportunity for buying off of an open production line has apparently closed shut on that possibility.

The C-17 is currently in production as a replacement for the C-141 Starlifter aircraft. Like the E-6, this aircraft certainly possesses, in fact far exceeds, the speed, range and payload capability necessary for MPA operations. Its on-station endurance, particularly at low altitude, and its maneuvering capability would have to be evaluated. In addition, building in a weapons carriage and delivery capability, both on the wings (currently a problem area on the C-17) and in any newly designed bomb bay, would be a complex task. Here the C-17 suffers from a problem similar to the C-130, with virtually no structure or space below the main cargo deck (essentially the entire inside of the aircraft) into which to incorporate a bomb bay.

The P-3 itself, of course, may be considered a military "derivative" from which to build a new MPA. The Naval Air Systems Command (NAVAIR) MPA program office (PMA-240) has quite naturally, examined this alternative. Termed the Orion II, this proposed aircraft would meet projected operational requirements in an airframe very similar to the P-3, but incorporating the following:

-- new engines, yielding greater speed, range and endurance

-- wing structural strengthening

-- increased payload capacity

-- avionics improvements

-- reliability and maintainability improvements

-- manufacturing and producability improvements.[22]

With eight Lockheed P-3s on order for delivery to Korea in 1995, a follow-on buy to that purchase might seem like a very attractive option. However, with the long lead times required for aircraft production, the window of opportunity for such a purchase has already closed. That is not to say a subsequent purchase of P-3 derivative aircraft would not be possible, only that the line would likely have to be restarted to do so.

4. Refurbishing Existing P-3s

This is another option which has been developed by the NAVAIR MPA Program Office. The sustained readiness program (SRP) is intended to "preemptively replace airframe components and systems identified as having potential for significant impact on future availability due to

excessive time to repair, obsolescence, component manufacturing lead time or cost impact that may result in loss of aircraft from the operational inventory."[23]

Due to its basing and operations in the extremely corrosive marine environment, the P-3 has been experiencing corrosion problems that will prevent it from achieving its full fatigue life. The SRP is designed to provide the material upgrades necessary to capture the fatigue life remaining on the aircraft. It would do so by conducting major corrosion repair/replacement on the fuselage, wing, spar cap, flaps and empennage, as well as replacing control cables and much of the aircraft's wiring. By essentially marrying the material condition of the aircraft with its fatigue life, this program would keep the aircraft sustainable out to its current service life of 29.5 years and partially offset inventory shortfalls.[24]

Although this alternative serves as a partial solution to coming inventory shortfalls, it is merely an interim solution which pushes the decision to purchase a new MPA further into the out-years. However, in view of overall fiscal pressures on the DOD budget, it must not be discounted as a possible solution.

VIII. CONCLUSIONS

The preceding discussion provides a wide range of options for meeting our MPA requirements for the next century. Of significance is the fact that the requirements are changing, even as this paper is being written. The number of aircraft needed to meet the challenges of the future is a moving target. Not only the United States, but many of our allies are wrestling with evolving requirements and diminishing defense budgets. Economic conditions and worldwide

interrelationships further complicate each nation's defense procurement decisions. The situation is complex and hard to distill, but let me conclude with three main points.

Industrial Base Considerations

In this period of defense downsizing, the United States must ensure that its industrial base for military hardware does not erode precipitously. This includes maintaining robust research and development programs, as well as production capabilities. The MPA airframe, however, does not derive from technology which is only of military utility; rather, it is based upon technology which is broadly applicable to the wide spectrum of aircraft production. Fighter aircraft, on the other hand, share lessons with the broader category of aircraft manufacturing, but clearly rely heavily on development and production technology which is much more focused on military-only characteristics.

Therefore, I do not think it is imperative that the United States be the sole manufacturer of future allied MPA. Although benefits could accrue to our industrial base overall, and the balance of trade could be enhanced (at least in theory) with sales of U.S.-manufactured aircraft to allies, I think large gains or large sales are unlikely -- without cooperation -- in the current world climate.

For the same reasons, continued R & D for an improved MPA airframe, so the technology can be put "on the shelf" for subsequent production, is unnecessary. We must, however, continue to develop new sensors and avionics, lest our technology edge be lost in these areas. As long as the MPA requirement exists -- and it should into the foreseeable future -- new mission sensors and avionics must be developed, so they can be placed into whatever MPA airframe emerges.

New or Derivative Aircraft?

Here the issue is muddy, and highly arguable, as well. As described in the preceding sections, derivatives have intrinsic appeal, but, under the surface, often have significant impediments to conversion to MPA application. The only aircraft which clearly lends itself to fulfillment of the future MPA requirement is the P-3, and it is now too late to follow-on to the Korean buy. All other derivative candidates would likely require such significant modifications that they would emerge as virtually new aircraft anyway. I think the distinction is, in the end, one of semantics. The next MPA can be a new aircraft, a highly modified "derivative" aircraft or even an improved P-3, an Orion II. That is not the driver. It is how to finance the development and procurement that is critical.

International Collaboration

I believe that the key to building a new maritime patrol aircraft is through international collaboration. To provide the greatest chance for success, this should be a coordinated effort between the military and manufacturers of the nations involved.

The aircraft requirements should be developed through the NATO Naval Armaments Group. Information Exchange Group (IEG) Four on maritime air has already begun to study MPA replacement plans. A coordinated effort to refine and match mission needs and capabilities across several countries, especially the U.S., Great Britain, Germany and Italy, should enable spreading development costs among participants. Commercial and military derivatives should be studied (from among those previously discussed) to provide an existing platform from which to build.

The U.S. Navy must take the lead in this effort. Although the Europatrol consortium is, perhaps, the first step in codevelopment of a common MPA, the U.S. need not be excluded. The Navy, working through the MPA Program Coordinator (N8803), Navy International Programs Office (Navy IPO), and the NAVAIR MPA Program Manager (PMA-240), should initiate dialogue with manufacturers (Lockheed, McDonnell Douglas and Boeing) to stimulate interest in joining Europatrol, or, as an alternative, some of the Europatrol companies, in a collaborative effort. Such a effort could be named **Alliedpatrol.**

In this time of shrinking defense budgets -- not just in the United States, but throughout the world -- the likelihood of nations investing large sums of money in any new development program is low. It is non-existent without a current, valid requirement. The most critical step in the development of any new weapon system, therefore, is validation of the military requirement. This should be coordinated through the NATO IEG, if possible (to widen the base of support), and by the U.S. Navy independently, in any case. The requirement for an MPA will remain valid for the foreseeable future; it is only the number of aircraft required, and when, which remains in question as the national security environment changes and military missions evolve to meet those changing needs.

Once the requirement has been validated, and the basis for collaboration established, the U.S. Navy must, of course, move to have the program funded by the Secretary of Defense and, ultimately, the Congress. If it has been a coordinated effort, however, with our NATO allies as well as with aircraft manufacturers, the program will stand a much greater chance of success. A collaborative approach can drive down the costs of a new aircraft and at the same time further enhance our commonality and interoperability. An approach such as this needs to be taken.

Codevelopment, coproduction, offsets, derivative aircraft -- all of these tools must be employed to minimize the cost and maximize the gain for each nation involved. We simply cannot afford business as usual.

ENDNOTES

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4. Ibid.: pp. 849-859.

5. Lockheed Aircraft Corporation Briefing, "Maritime Patrol Aircraft in a Changing World." August 28, 1992.

6. Slavy, Robert, Mark Hewish and Guy de Bakker. "Maritime Patrol Aircraft: New Wine in Old Bottles?" International Defense Review 2/1990: pp. 162-164.

7. U.S. Navy MPA Program Coordinator Office (OP-503) briefing, July, 1992.

8. Slavy, et al: p. 164.

9. Smith, Bruce A. "Navy Cancels Lockheed's Contract to Develop P-7A." Aviation Week and Space Technology 30 July 1990: pp. 16-17

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21. U. S. Navy MPA Program Manager Office (PMA-240) working paper.

22. U. S. Navy Program Manager Office (PMA-240) Briefing. "P-3 Orion II Program." 9 September 1992.

23. U. S. Navy MPA Program Office (PMA-240) Briefing. "P-3C Sustained Readiness Program." 9 September 1992.

24. Ibid.

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P-3C FORCE LEVEL REQUIREMENTS/INVENTORY (USN)

• FORCE LEVEL REQUIREMENTS

ACTIVE	18 SQDS PAA 8	=	144
RESERVE	9 SQDS PAA 8	=	72
FRS	25%	=	36
RDT & E		=	11
VPU		=	4
PIPELINE (10%)		=	26
			293**

*DRAWDOWN

	FY90	FY91	FY93
ACTIVE	24	20	18
RESERVE	13	13	9
INVENTORY	367	328	293

*END OF FY REQUIREMENT
**ASSUME (1) CONGRESS DOES NOT DIRECT 13 RESERVE SQUADRONS
(2) NO ATTRITION (O5)
(3) P-3Bs NOT RETIRED FY93
(4) NO SRP

• INVENTORY

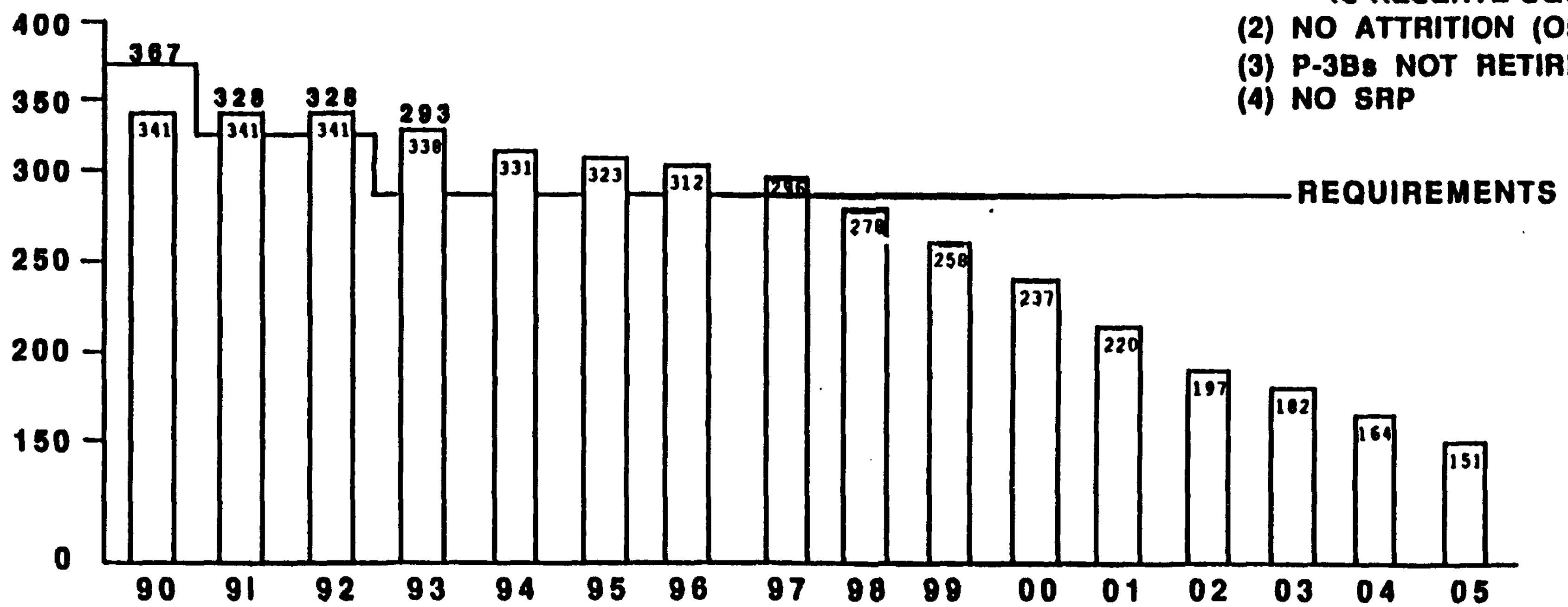

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Table 1